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ABSTRACT

A program was devised and presented to four classes of college freshmen who demonstrated a need for remedial English instruction. An experiment to ascertain relative merit of programmed and conventional classroom presentation was conducted. The program was divided into phonetic spelling, basic word usage, effective sentence construction, and basic and advanced paragraph construction. Each of six teachers administered the program to 25 experimental and 25 control students. Experimental and control groups were administered the following tests: (1) a comprehensive pretest over the entire program, (2) a pretest over each unit, (3) a pretest and as many posttests as necessary for the student to make [illegible] 85 on a 100-point scale for each lesson in each unit, (4) a general posttest over each unit, and (5) a final comprehensive posttest. Using the Spearman Brown statistic for reliability, a sampling of pretests indicated a reliability of 0.85, of posttests a reliability of 0.65, and of the comprehensive final examination a reliability of 0.88. A summary of general conclusions includes: (1) A programmed approach to learning must have a valid, precise, and complete statement of objectives; (2) The innovational teaching approach must be proved markedly superior to the conventional classroom procedures if a change is justified; (3) The program should be structured toward the "average" student, but should allow for individual rate of progress with an open-end semester. (Author/CK)

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U.S. DEPARTMENT OF
HEALTH, EDUCATION AND WELFARE

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Preface

To the late Dr. Coramae Thomas who initiated the program at Tarrant County Junior College, to Professors Ann Burgin, William Holt, Anna Ryan and William Stupp who taught it, to students who studied it, to Mr. Tom Bisbee, Institute for the Study of Cognitive Systems, Texas Christian University,who analyzed it, to Mrs. Mary Nicholson who typed and edited it, to Dr. Gwen Mulkey, Chairman, Humanities Division, Tarrant County Junior College, who took care of all the crises which arose during the writing, and to educational innovators who are moulding change to meet the demands of the age, this research is dedicated.

Marjorie Barksdale

August. 1971

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SUMMARY

In an attempt to remedy weaknesses in the remedial course for beginning college freshmen with one or more deficiencies in the ability to communicate in writing, a program was devised, tested, rewritten, and presented to four classes of students whose need for remedial instruction in English before attempting freshman composition had been indicated through tests. Areas of weaknesses in the program were isolated and corrected. An experiment for the purpose of ascertaining relative merit of programed and conventional classroom presentation was conducted. The program was divided into five areas: (1) Spelling through Sound-Symbol Correlation; 2) Basic Word Usage; 3) Effective Sentence Construction; 4) Basic Paragraph Construction; and 5) Advanced Paragraph Construction. Six teachers participated in the experiment. Each instructor administered the remedial program to one class of 25 students called the Experimental group and taught the same material in the traditional manner to another section of 25 students called the Control group. Scores of 148 pupils completing the course provided analytical da-

The following tests were administered to both the Experimental and the Control groups: 1) a comprehensive pretest over the entire program; 2) a pretest over each unit; 3) a pretest and as many posttests as necessary for the student to make a grade of 85 on a 100-point scale for each lesson in each unit; 4) a general posttest over each unit; and 5) a final comprehensive posttest.

The purposes of the experiment were to test whether the program realized the behavioral objectives established before the writing of the program and whether the results indicated the superiority of the program or of conventional classroom procedures. The experiment also attempted to measure variables such as: 1) effectiveness of the teacher; 2) the relative success of students admitted to the course in remedial English through a high school diploma or through some other form of qualification; 3) the relative success of pupils who had been out of school 0 to 2 years, 3 to 6 years, and more than 6 years; 4) possible significance of sex as a factor in success with remedial English; and 5) possible significance of age.

Based on the Spearman Brown statistic (Nunnally, 1967) for reliability, a sampling of pretests indicated a reliability of 0.85, of posttests, a reliability of 0.65, and of the comprehensive final examination a reliability of 0.88.

Separate one-factor multivariate analyses (MANOVA) of variance were run of the data for each of the variables. The most important aspects of the analyses with regard to the evaluation of the success of the program were the multivariate analyses of variance on the scores of the Experimental and the Control groups. The first of these was done on the prescores to determine if a priori differences existed between the two groups. No significant a priori differences were found. The MANOVA on the posttest scores resulted in a significant chi-square (X^2) of 284.67 which with 30 degrees of freedom (df) is significant at the 0.001 level. The Experimental group scored uniformly better on all posttests except Basic Paragraph Construction. The failure of the Experimental group to score better than the Control group on Basic Paragraph Construction is at least partly explained by the fact that the Control group scored better on that unit on the pretests. The improvement score MANOVA produced an X^2 of 26.73 with 5 df, which is significant at the 0.001 level. Large differences in improvement scores in both Experimental and Control groups indicated that the teacher is an important variable. The prescore MANOVA for students admitted to the course with a high school diploma and those admitted with some other form of qualification resulted in a significant X^2 of 14.85 with 5 df and $p \leq 0.025$. The MANOVA on the posttests yielded an X^2 of 19.05 which with 5 df is significant at the 0.005 level. Pupils admitted under other qualification than a high school diploma scored higher on Basic Word Usage, Effective Sentence Construction, and the comprehensive final examination. High school students scored higher on Spelling through Sound-Symbol Correlation, Basic Paragraph Construction and Advanced Paragraph Construction. The MANOVA on the improvement scores was not significant at even the 0.05 level. Thus while the experiment indicated that high school students and those pupils with other forms of entrance qualifications have different areas of strength as the various test means indicate, no overall differences between the two groups in terms of posttest scores were found. No evidence suggested differences in abilities of the Experimental and the Control groups to learn course content. A measurement of the performance of students who had been out of school 0-2 years, 3-6 years and more than 6 years revealed that the group away from school for more than 6 years made higher scores on each of the tests except the test on Basic Word Usage. Various tests broken down by age and by sex indicated no important differences between groups on these variables.

A summary of general conclusions includes: 1) A programed approach to learning must have a valid, precise, and complete enunciation of objectives which shape content

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and methodology. 2) The innovational teaching approach must be proved markedly superior to the conventional classroom procedures if a change is justified. 3) The program should be structured toward the "average" student but should allow for individual rate of progress with an open-end semester. 4) The teacher should act as a tutor and grader. 5) If a large per cent of the students consistently require individual assistance, the program should be rewritten or discarded. 6) The selection of the paradigm is of paramount importance to the success of the program. 7) The student should accept total responsibility for his progress. 8) The program should follow the Skinnerian theses of reinforcing acceptable performance and conditioning out error. 9) The program possesses rich adaptability to meet democratic and economic demands for universal education. 10) Critics of the program believe that the program results in a fragmentation rather than a synthesis of experience, that the program decreases initiative and creativity, and that it precludes the Gestalt concept that the pattern transcends the sum of its parts. 11) Detractors condemn the elimination of pupil-teacher and pupil-pupil dialogue and object to the ceiling and boundaries of the program.

General recommendations include: 1) Further research and experimentation in programed instruction is urged. 2) The education of teachers in the writing and the teaching of programed instruction is an imperative educational need. 3) The results of experimentation in programing should be shared.

Specific recommendations include: 1) Research in the field of remedial English based on a comparison of a semi-programed approach with a completely programed approach is timely. 2) Research in the field of a programed course for freshman composition is advised. 3) A programed course in English and in American literature is recommended. 4) If these courses prove valuable, programed courses in literatures of Western Europe and even of the East could be considered.

CHAPTER I

BACKGROUND FOR THE STUDY

Any possible significance of the research project herein described lies in: 1) the program which has been developed;* and 2) the value of the program in discovering an effective method of teaching communication skills to college freshmen who have one or more deficiencies in the ability to communicate in writing. Certain background materials, however, seem pertinent: 1) justification for the study; 2) a brief history of programed instruction; 3) a rationale of programed learning; 4) criteria of an acceptable program in the field of communication at the freshman level for entering students with specific deficiencies in writing; 5) the advantages of programing; 6) the disadvantages of programing; and 7) the role of the teacher in programed learning. Limitation of the section on background material is that it does not include at any point in-depth research. The purpose of the section is to acquaint the reader with the more general aspects of programing as that teaching technique applies to general areas of learning. Specific criteria have been confined to the specific program here under consideration.

Justification for the Study

Although the microcosm of the research project herein presented has been an attempt to produce and to evaluate a program which, through the testing of an Experimental and a Control group of students, will be found to be superior to the traditional classroom approach long used in conventional education, the macrocosm of the investigation deals with perhaps the most essential tool of man: communication. In order to function in any society, and particularly in the complex modern world, man must communicate because without this power to convey thought man would be in isolation and would surely perish. Man's inability completely to express himself is a major cause of the social lag which, in turn, may cause the extermination of the species. Furthermore, the ability to exchange thoughts is essential to the functioning of the educative process. This study then, in a larger sense, is justified by the immediacy, urgency and imperative necessity of mass education. The macrocosm is thus reflected in the grim twentieth century alternatives: educate or perish.

*The complete program administered to the Experimental Group is seen in the Appendix, Volume II, of this report.

The untrained individual today has no marketable value. In advanced countries the ignorant is not only a misfit to himself but a tax burden to his fellows. In backward countries, consummating almost overnight a thousand-year economic and social leap, the unskilled has no place because even here atrophic brute strength is economically unnegotiable. In short, the business community must have educated workers. Hence the proliferation of community and junior colleges all over the nation and the crying need for such a course in communications as has been attempted in this research.

If the inability of the uneducated worker to make a contribution to twentieth century society resulted only in the expenditure of the tax dollar and the corresponding shrinking of the gross national product, a country with the affluence of the United States might well manage to afford the vast waste of human potential. After all, other tax dollars would surely be saved, for the cost of education is--unless comparison is made with the cost of war--somewhat heavy. But changes are accelerating in the waning decades of the twentieth century. Political philosophers warn that the youthful experiment in democracy is showing grave signs of premature obsolescence and they anxiously inspect the ship of state for a slow leak or a rotten hull. They believe that the democracies must take on new vigor, chart a new direction, make a new beginning, if a once and perhaps still cherished way of life is to be perpetuated. The cultivated mind must be not only the protection for democracy but the savior as well--if the savior is capable of saving. Education is at the very heart of the salvation. There is neither margin of time nor for error. Rioting students, anxious educational administrators and teachers, apprehensive citizens, and the very age itself demand immediate, right choices.

Granting that nothing less than effective education for all people will suffice and that now is the time to begin does not cause the educational predicament to disappear. The pertinent question remains: <u>how</u> shall changes be brought about? The crux of the problem is multi-faceted. Cost, training of teachers, curricula, and methodology complicate a ready solution. The conventional classroom formulas for learning and teaching--the lecture method, supplemented by questions from the teacher and answers from a few of the brighter students--based on the philosophy of one amount, degree, and rate of progress for all students is being subjected to increasingly critical scrutiny. Dissatisfaction with the <u>status quo</u> is rampant.

Questions of relevancy in curricula, authority in policy making, and methodology bombard academe from the echelons of boards of regents to the strata of classroom teachers and students. Pertinent issues include the large number of students that must be educated, class size, variation in pupil ability, heterogeneity of achievement levels within standardized grade levels, on the one hand, balanced against the not-to-be-disputed desirability of a one-teacher-one-pupil relationship for maximum pupil progress. Because the keynote of education in the seventies is innovation, stereotyped patterns have been judged wanting, and any novel approach is likely to be accepted for evaluation, at least for the nonce, for no better reason than that it is different, untried, and educationally fashionable. Some of the new approaches will be rejected. Others will accelerate the learning process and will be used and widely imitated. Because of the urgency for mass education, it is necessary to evaluate new programs immediately and thoroughly. This project evaluates and tests one such innovational program, one of the more favored changes in education, the programed approach to learning and teaching which, along with team teaching, is the "in" educational technique, particularly for courses requiring specific skills.

The teacher with background and training in programing is smiled upon by progressive school systems and is visited by competitive representatives of various publishers who ask to see the manuscript from the very earliest stages of program planning when the course is little more than a thought wave in the writer's mind. A school without at least one program going is sometimes viewed as somewhat outdated. Extravagant claims for programed learning are made by its devotees whose contentions are countered by extravagant denials of the merits of programing by some of the disparagers of programed learning. A meeting of minds will occur only when many research projects comparing the relative merits of the programed course and the more traditional classroom approach indicate that one method is indubitably superior.

A Brief History of Programed Instruction

Programed learning was an accepted technique of the process of education long before experimenters in behavioral psychology conducted certain experiments with rats and other lower animals and came up with the theory of the value of psychological reinforcement in the learning

process. Actually, the learning now known as the programed pattern is by definition "bit" learning, following a preconceived and pretested sequence, the retention of which is systematically and frequently reinforced both through immediate testing of "bit" responses and long-term testing of retention.[1] Less than modern examples of the theory and application of programing abound. Socrates, for instance, through "bit" learning in the form of a question, moved sequentially to ever-increasing complexities of form and substance.[2] Descartes enunciated the principles of programing when he noted that in learning, generalizations should be avoided. Descartes suggested that the material to be learned should be divided into many parts; the multiplicity of the division should depend upon the nature of the material and the problems within the material. The acquisition of knowledge, said Descartes, should be initiated with simple easy parts and should thereby ascend to the more complicated structures. Through complete enunciations and comprehensive review, anything pertinent to the problem should be omitted.[3]

These two random examples could be multiplied fruitfully with similar instances from almost every ancient who wrote concerning the learning and teaching processes, but such a survey is without the provinces of this study. Pertinent to the inquiry, however, is a brief statement concerning the beginnings of twentieth century programing. Sidney L. Pressey, an Ohio State University psychology professor, in 1926 pioneered in programed learning through the invention of a machine originally conceived as a contrivance for testing. But the series of questions which were presented to the student by the machine provided immediate right or wrong answers.[4] The chief weakness of the machine from the standpoint of perfected programing was that the questions and answers offered no patterned sequence of progressing complexity. /Programers now believe that sequential learning is easier to retain than disjointed "bit" learning./ Furthermore, the great depression turned men's minds to food, shelter and survival. Further research which might have been expected to follow Pressey's lead did not at that time continue. Pressey, however, continued to publish in the field of programed learning.[5]

In the early 1950's at Harvard, two psychologists, B. F. Skinner and James G. Holland, devised and popularized in educational circles their own self-teaching approaches to the learning process.[6] Following the contributions of Skinner and Holland, most of the work on programed instruction subsequently used psychological knowledge of the

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learning principles which had in fact been known a number of decades before that knowledge was seriously applied to the development of instructional devices. Within the late 60's and the early 70's, a plethora of effort has resulted in a large number of published and unpublished programed courses in almost every field of learning, but demand for adequate programed instruction far exceeds the supply.[7]

Rationale of Programed Learning

Central to the theory and practice of programed learning are the psychological principles advanced by Skinner: that a complex body of learning can be separated into small components, and that these components can be taught through student responses which may be reinforced or extinguished.[8] Motivation of student action is based upon positive approval of student accomplishment through praise or tangible reward which indicates that an organism--lower animal or human--has performed successfully.[9] The recognition may be either direct reinforcement--a specific reward for achievement--or it may be conditioned reinforcement--a recompense which may be exchanged for a tangible reward. Students are motivated, for example, by grades, publicity, prestige, admission to higher levels of education, or by increased ability to earn goods and services--better jobs or marriage partners than they would otherwise have been able to obtain. Learning is extinguished, on the other hand, by a quick substitution of a correct response for an incorrect one. When the response is right, the opportunity for recompense is thereby obtained. The idea of "quick substitution" is basic in programed learning.[10]

Among the hypotheses governing direct and conditioned reinforcements are: 1) an individual learns and changes by realizing the consequences--with their involvement in pain and pleasure sequences--of his actions; 2) reinforcement strengthens the impetus toward repetition; 3) quick reinforcement motivates behavior more effectively than delayed reinforcement; 4) delay or absence of reinforcement weakens the probability of repetition; 5) intermittent reinforcement keeps the learner at his task; 6) differential reinforcement which rewards desirable behavior and does not reward undesirable behavior is effective in the learning process; 7) motivational reinforcement not only makes repetition more probable but increases activity, quickens pace, and heightens interest in learning; 8) behavior can be developed into a complicated pattern by shaping the simple elements of the skills, ideas and concepts desired and by combining the skills, ideas and concepts into a chainlike sequence.[11] The final hypothesis is of course the very

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essence of the theory of programed learning. Thus programming enables the student to recognize that he is learning, to know what he is learning, and to see that the process of learning is enjoyable.

Although the initial psychological experiments which formed the basis for present-day programed learning were conducted in groups, with lower animals as subjects, the direction of auto-instructional learning has turned to a one-to-one-teacher-pupil relationship. Ultimately it must be recognized that Skinner's reinforcement theory is a hypothesis. Implemented with a clear sequential methodology, it provides a systematic approach to the experimental analysis of the processes of sequential learning and of retention--the avenue to learning upon which programing is based. A transfer however from the laboratory, where experiment rests heavily upon animal learning, to experiment in the schoolroom, which relies upon a situation of a different type of learning and which assumes a transfer ability from overt animal activity to complex verbal human behavior, is not necessarily a valid transition. The proof of the program is in the results. Only through wide in-depth experimentation can the value of the programed approach to learning be empirically established.

> Of vital concern to programed instruction is the retention of an experimental attitude over and above adherence to any doctrine or theory, however scientific. Science can take care of itself. Technology often goes astray.[12]

In order to ascertain the merits of programed learning, experimentation must be based upon a comparison of the relative efficacy of the programed approach in direct juxtaposition to the more conventional classroom teaching. Upon the necessity for comparison rests the specific justification of the research project herein described. A consideration of the relative advantages of each method will be viewed from the standpoint of the programed approach. Hence criteria for an acceptable program should be considered and evaluated.

Criteria for Programed Instruction

The first criterion for an adequate program must necessarily be a valid, precise and complete enunciation of objectives. Content and methodology must be shaped to achieve stated goals and all learning frames written, tested, re-written, and re-tested to realize the formulated

goals. The final criterion, on the other hand, should be a fulfillment of behavioral objectives. If the program fails to achieve this end it must be either re-written until the objectives are, through independent testing apart from the program, realized or, if such a validation cannot be obtained, the program has proved itself worthless and should be discarded. If the program is only as good as, and not better than, the traditional classroom methodology which has been called into question by the very appearance of the program, then the program has not justified itself. It must be replaced by a better program or programed learning must take its place among the many other educational theories which have not been found valuable in the learning and teaching processes.

The time factor is also an important aspect of the program. Although perhaps the greatest advantage claimed for programed learning is that the student can proceed at his own rate of speed, the length of time required by the average pupil progressing at the average rate of achievement should be taken into account in the planning and writing of the program. /Only the combination of experienced teacher and skilled programer can hope satisfactorily to define and write for the "average" student with his "average" rate of progress. At the present writing, such a combination in one fortuitous union of skill, talent and experience is rare in the teaching profession./

Another essential point in a listing of essentials in programing is the amount of content material in an individual program. If content is too meager, lack of specificity will retard achievement and dull pupil appetite for realization of goals. If, on the other hand, the program offers an undue multiplicity of frames for the same sequence, lack of stimulation and repetition will result in pupil boredom. A nice balance in presentation of material must therefore be maintained.

The nature of content in course presentation is of course the primary criterion to be considered. Above all, the material must be accurate, timely, reliable, and pertinent to the behavioral objectives previously determined. The program must be clear. It must not suffer from lack of focus due to vague or faulty emphasis. The program should avoid too much cueing and prompting which works against permanent retention and pupil initiative. Yet the material must be simple enough for the student to learn it, largely through his own cognitive and initiative processes. The teacher serves as tutor, to be sure, but if too many

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students need constant tutoring, the program is obviously not functional.

Superiority in coherence and in style enhances the acceptable program. Context must be appropriate to subject matter; examples should emerge logically from the thesis, principle or skill developed by the program. Sequences must develop logically without extraneous materials. The very nature of the learning process by reinforcement demands that irrelevant material be excluded so that it will not have to be extinguished subsequently.

The amount of material to be included in a single frame is a difficult and most important point to be determined. A frame, after all, is an artificial device, created by an author arbitrarily as a method or device to separate "bits" or particulars of knowledge. Not only must the frames be appropriate to the learner from the standpoints of past achievement, grade level, behavioral objectives and sequential pattern, but the frames must also contribute to the general pattern which the course in toto presents. Frames must therefore be relevant, inclusive and yet limited to one item of sequential learning. Because the student will learn nothing in the course that is not in the program, it cannot be too strongly emphasized that all important material must be included and that, conversely, no material must be put in the program merely for extraneous decoration or embellishment.

Style should be suitable to the learning level of the student for whom the material is written. Because programed learning cannot depend upon a stimulating verbal exchange initially sparked by a dynamic teacher, the prose itself must be appealing to the reader who will have no class lecture for background and no stimulation from pupil participation in discussion. The program must stand or fall on its own merits. It must appeal to the student. If the style is pedantic or dull, the student will turn from and abandon the program. If the approach is light, flippant, conversational, or dramatic, the student will think he is watching television and will be entertained rather than instructed. The program must strike just the right role stylistically.

Reading level must also be neither too complex for understanding nor too simple for the enrichment of vocabulary. A provision for a variety of responses must be made so that the learner will be less interested in the right answer than in the content of the program. Graphic

illustrations and the use of the media frequently enhance the program.

The Advantages of Programed Learning

Programing possesses various structural advantages. Each small item of sequential information, called the frame or the paradigm, is viewed as an entity which, because of its small size, can be learned quickly and readily. The choice of the paradigm determines the basic outline and direction of the program. The paradigm indicates the nature and development of learning and ultimately achieves the behavioral objectives and the goals of the program. For short sequences built upon gradation, the linear or extrinsic program successfully elicits easily reinforced responses, built upon specific stimulation. In the linear sequence if the student chooses the wrong answer, the correct one is immediately exposed. The linear paradigm is reinforced additionally by sufficient review and restatement.[13]

A second sort of paradigm, conversational chaining, originated by John Barlow, is closely related to linear programing. The difference is that the linear approach has discrete question-answer pairs, whereas conversational chaining makes a new response contingent upon a prior choice. The program is more difficult to construct but has the possible advantage of more favorable student reaction in that the student does not feel that each choice is a separate entity and is therefore a test. Instead the student has the impression that each choice is an interrelated chain which resembles the sequential flow of meaningful conversation.[14]

The intrinsic program, developed by Norman Crowder as a teaching device to train armed forces personnel in the understanding and use of electronic equipment, is presented in units. A test given immediately after the presentation of the unit determines whether the student is ready to pass immediately to the next unit or whether he needs further work on the unit on which test scores indicate he has shown less than acceptable proficiency. If the student needs further work on the unit, he turns from the unit structure to branching, a kind of sidetracking from the main progress of sequential unit development.[15]

Branching can be adapted to student needs because of its flexibility. Branching may consist of either a few very simple remedial structures or elaborate ramification of

such aids.[16] Behavioral objectives of the course constitute major factors in the choice of the paradigm's branching because the structure of the program has the most direct and pivotal role in the ultimate efficacy of the devices for success in course offerings. If the unit involves simple skills which pose no problems in presentation, the linear or extrinsic paradigm, or some of the many modifications of the linear, is recommended. If the unit necessitates discriminative choices, the chain or intrinsic paradigm is likely to be preferable. No hard and fast rules can be stated. The programer can adopt almost any paradigm, or any combination of paradigms, to his own immediate needs and ultimate purposes.

Regardless of the choice of paradigm, the essential features of good programing and the desirable characteristics of the program remain the same. These features include: the presentation of small installments of knowledge and descriptions of skills which contribute sequentially to the larger body of material to be learned; the strengthening of motivation through reinforcement, and the denial of stimuli which motivate error; the immediate correction of error; a progress from simplicity to complexity in material; and accurate and appropriate mechanism for constant checking and evaluation.

Another significant advantage of programed learning is its structural adaptability to variations in pacing. Progress in the program can be measured at different rates of accomplishment. Thus the programed package is of advantage to the rapid, the average, and the slow learner. The pupil able to make rapid progress is not slowed by questions the answer to which he already knows. He is not required to delay his own progress until his more obtuse classmates are ready to advance. The fast learner, needing no additional drill, works as rapidly as his abilities permit toward well-defined and specifically realizable goals. When he has finished the programed course, he has extra time to turn his attention to some other course on which he may be behind--probably a non-programed offering.

The slow learner with his more leisurely pace finally arrives at the skills and proficiencies which the more apt students earlier attained. His teacher is able to give him a considerable amount of individual attention because the rapid learner has not needed tutorial services. Regardless of speed of progress, all learners accept the total responsibility for their own success or failure in the programed course. This knowledge of student responsibility is in itself a motivation.

A further advantage of programing is that the program is always correct and accurate. It has been tested, revised, and, at times, completely rewritten. It has been retested and perhaps rewritten again so that content contributes directly to behavioral objectives. The teacher in the traditional classroom is frequently called upon to speak impromptu concerning a topic or perhaps a subject in which he has less than scholarly knowledge. This statement is no reflection upon teacher training or preparation. A teacher has a much broader view of a field than a program contains, but the printed word, within the narrower range of its applicability, is scientifically more dependable--at least in certain situations with reference to certain teachers. Furthermore the program is always timely and relevant because it is frequently changed to lend itself to the spirit and the matter of the times. Unnecessary, digressive and personal material is either not put in the program or is eliminated in the first revision and rewriting.

Absenteeism is not fatal to pupil progress in the programmed approach to learning. The conventional lecture or question-and-answer period floats out on the air and is forever gone unless the student always has with him a tape recorder. The program is always within the pupil's physical and intellectual reach. The learner may choose his own time, conditions, circumstances and places for the learning activity. If he is motivated and bright, he may simply appear in class, take the posttest for the lesson he has already mastered, pick up the next lesson and leave. His superior accomplishment is thus not embarrassing evidence to his peers whose accomplishment rate is less impressive.

Finally, because of the exigencies of the population explosion, innovators in programing predict that all educational offerings of the near future will of necessity be completely programed, the only possible exception being the small, rich, privately endowed institution which can, because of superior purchasing power, provide excellent teachers for very small groups of students.[17] The projection above is limited to the field of education beyond the high school, but the schools below college level no doubt will accelerate programed learning to meet their own problems of burgeoning enrollments.

In summary, the advantages of programed learning include superiority in psychological insight into the learning process, structural variety, freedom of pacing, excellence in content, freedom in learning individually, and adaptability to the demands of mass education.

Disadvantages of Programed Learning

Certain difficulties and disadvantages are inherent in programing. Economically, the cost of packaging a program is ultimately much greater than the cost to the school and to the pupil of preparing a conventional textbook. Even if the entire cost of writing the traditional textbook is included, the cost of programing is higher. In most cases, the benefits to the textbook writer are not measured in dollars and cents but are contained in a gradation ranging from the satisfaction experienced by the scholar who says in print that which he thinks is important and which should be said, through such motivations as prestige, promotion in rank and/or salary, or fulfilling the requirements of a "publish or perish" policied institution of higher learning. Once the textbook is published, it will be used a number of years before revision is necessary. Often revision is a supplementation rather than a complete rewriting of course content.

The initial cost of a program, written originally for one subject area in one particular school, though it may be handled commercially if it proves useful and popular, is only the first step in an expensive spiral of pretesting, writing, posttesting, submitting to students in order to discover weaknesses of the program, rewriting, retesting of new material, resubmission to students, posttesting, until the program is judged as perfect as it can be made.

Experimentation in the writing of the program is never ending. Realistically, the program must be paid for, and the price is--or should be--high. If the programer is not a highly trained specialist, the program is not worth the time, effort, and cost, however slight. The combined abilities to write well, to teach well, to program well, and to desire to write programs are rarely found in one individual. Such a gifted person seldom chooses the difficult and materially unrewarding profession of teaching school. If such a person is able to produce a program, he commands and deserves high pay. Lysaught and Williams have called programing "inspired drudgery"[18] and have noted that in 1962 "programed learning is still in the exhilarating stages of early experiments and the first flush of primary application."[19] The contemplation and the vision of possible beautiful results of programing may indeed be called exhilarating. A realistic experience with programing would stress the "drudgery," not always accompanied by inspiration.

Not only is the envisioning, the planning, and the writing of the program arduous. The time for development of the adequate program is sizable. Unless the program is published, the materials are so bulky that the instructor at times feels more like a mule on a treadwheel than a contributing specialist. Publication must not be considered, furthermore, no matter how attractive the publication offers, until the program is set, stabilized and proved more valuable than the traditional approach. It is not enough that the program be as good as the conventional classroom learning situation. It must be appreciably superior or the transfer would not be justified.

The advantage of individual progress at individual speed is offset somewhat by the large amount of material which must be handled daily by the instructor and students. For example, if the program included fifty lessons, some forty to forty-five might be needed in the classroom daily if the number of people in the class included forty-five people or if one advanced student were able to handle more than one lesson in a class hour. Of course the above example is an extreme instance. Possibly no more than ten or fifteen lessons would be used in one class hour, but even so, that many lessons plus pretests and posttests constitute a burdensome amount of material.

In a large class, the need for immediate grading complicates the class hour. If the instructor turns into a mere paper shuffler, he defeats the advantage of an individual tutor for each pupil. If he grades steadily, allowing time for a conference with each student concerning major errors in the choices, he will perhaps not finish grading all the papers at the end of the period. Each student must know whether or not he is ready to be promoted to the next sequence. If all papers are not graded, arrangements must be made between instructor and pupil to meet at a conference period. A small office is frequently crowded with pupils waiting to have their papers graded.

The above disadvantages are material ones and, with the application of intelligence, money, and man power, these disadvantages can at best be eliminated or, at worst, controlled. A more serious objective to programed learning takes its basis in a characteristic claimed by programers to be an advantage: namely, the study of small disparate items of learning which programers call the very basis of the adequate program, small items possessing potential for complexity which through the accumulation of simple discrete parts constitute the heart of the psychological approach. Programers believe that an overview of the whole subject will finally emerge from an amassing of these tiny separate components of the larger subject area.

Advocates of traditional classroom procedures which are based on lectures, questions and answers, and group discussions do not accept what they term a too-ready solution of inherent difficulty in working with "bit" frames. The digressive material which classroom instructors supply and which programers eliminate is considered valuable by traditionalists. The results of a program, detractors contend, is narrowing. The learner of the program comes out of the program with a number of facts and skills but he also has a superficiality of view, a failure of understanding, and a fragmentation of experience. Furthermore, critics of programing contend that the program produces stereotyped conformity, a dulling sameness of outlook and experience which tends to eliminate individualism and personal creativity. When differences among students are leveled, heights and depths of individual experience are impossible. The program which boasts of being created for the individual does not, traditionalist critics affirm, allow for individual differences. When the advanced student learns the material of the program which he can master quickly, he turns for enrichment, the critics say, to the non-programed course which provides the valid experiences in learning which the programers have failed to supply.

Additionally, the learner is deprived of valuable experiences resulting from the interchange of ideas between that learner and his teacher in a normal situation of give-and-take of ideas. He is also cut off from the interaction with other student minds. The most civilized of all human arts--conversation--which some linguists say is a dying art is indeed threatened by the mass media. Programed learning simply adds to man's lack of inclination and of ability to communicate because the last student stronghold of verbal interaction is the classroom. If the tongue is silenced there, the ability to think, to express, to be aware of the problems of the human heart and to communicate them has been irreparably impaired. The program also destroys competition and cooperation, and even emulation among pupils. With the discouragement or the destruction of creativity, a false view of the nature and difficulty of intellectual achievement results from immediate knowledge of quick and superficial success--the mastery of a "bit" frame. The pretests and the posttests with their basis in itemized learning do not truly measure progress which is in reality based on comparative evaluation with other members of the class. Pacing is artificial. Real teaching should be structured upon the pace of mutual accomplishment of peers. Neither teaching machines nor any other media can take the place of the teacher and the other pupils in the learning situation. Electronic reproduction of information may usefully take

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the place of books and printing, but the verbal interaction of human minds is prerequisite to the cultivated life. In short, the restrictions of rote learning and the ceiling and boundaries of the program are, because of the very multiplicity of discrete items, stifling to the potentially wide-roaming human mind. (On a light note, the student, critics say, may react to the program as the third grader did to her outside reading book: "This book tells me more about penguins than I ever wanted to know."[20])

Some material does not lend itself readily to the programed approach, as, for example, the dictionary, the Bible, and this background study of programing. If, however, education of the future must be programed to meet the demand for universal instruction, research can no doubt aid in the formulation of programs with thematic subjects.

The final criticism of programs is based upon a Gestalt psychological theory: a synthesis of separate elements in the learning experience results in a functional configuration which is more than the mechanical sum of its parts. Critics of Skinner's reinforcement theory hold that the pattern or Gestalt cannot be realized through "bit" learning but rather that the conventional classroom is the best medium for the shaping of the Gestalt. A class under skillful guidance and with maximum student participation can reach a pattern or level which transcends the individual contribution. Educators who embrace the Gestalt view look upon education not as the acquisition of skills or even of specific knowlege within specific subject fields but as a change or alteration of human behavior through the development of new insights and the modification of understanding. Gestalt protagonists hold that new kinds of learning sequences can be developed more effectively in the traditional classroom than through programed instruction.

The Role of the Teacher in Programed Instruction

Teachers who instruct below the college level are by background, training and frequently by temperament timid and conventional. Their acquiescence to tradition, docility in taking orders, and antagonism to change may be based historically upon their subservient age-old role in the social structure as "servants of the prince."[21] Innovation in education has come not from teachers or even from schools of education but from research foundations such as Ford and Carnegie. Science reforms, it is true, began in

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the great universities but not in the schools of education. Furthermore, in various comprehensive achievement tests, general teacher ability (again below the college level of teaching) as compared to that of other professional and college educated groups is not competitive.[22]

Teacher interest in programed learning at the college level of teaching is strong. This interest is seen in requests for courses in the theory and techniques of programing and in many experiments with the writing of programs. Administrative interest, as has been indicated, is high, particularly in the community junior colleges. Zest for new learning materials and methodology may indicate that some of the younger generation of teachers are innovators rather than pedagogues only.

Traditionally much importance has been given to the role of the teacher in motivating student learning as well as in the actual process of attempting to impart knowledge to the student. The modern view of the value of the teacher in the learning process places great emphasis upon pupil motivation, though the question of the degree and effectiveness of teacher motivation is today open to controversy. If motivation is rarely possible, that is, if the pupil must motivate himself, then the program with its direct material-pupil relationship is superior. Granted even that the strong teacher can furnish pupil motivation, a question arises as to the relative opportunity for student encouragement in the programed as compared to the non-programed approach to learning.

Advocates of the program state that in the auto-instructional program, the teacher is almost an individual tutor and hence has superior opportunity for motivation.[23] Through individual conferences and person-to-person contact, potential for teacher motivation is increased.

Advocates of the traditional classroom say that teacher motivation in the program is limited by the ceilings and boundaries of the program itself. If the highest role of the teacher is to inculcate love of learning, and if the program is concerned with skills taught in "bit" sequences, how can the teacher fulfill his philosophical obligation to the student?

The proponents of the program answer that the teacher has not only as much occasion but even more opportunity to inculcate ideas and concepts: "The programed texts do for the schoolwork what the washing machine does for housework; they free the teacher for the things he can do best."[24] Furthermore:

> A teacher is a self-organizing program with infinite possibilities for guiding and interacting, transmitting attitudes, and re-directing or orienting the student. The fewer machine jobs the teacher has to do, the more time will be available for the student to exploit and benefit from the human skill. After all, it has been said that any teacher who can be replaced by a machine probably ought to be.[25]

If the pupil is lazy or disturbed, he cannot of course be motivated by any teaching method. Complete lack of motivation cannot be eliminated by teacher-directed activity nor by the program.

Teachers have been trained to teach non-programed material. They have had much experience in the traditional classroom. Most teachers are not trained to handle the programed course. Certainly an experiment poorly written and executed is worse than no program at all. "Trouble can be expected from those who, meaning well, embrace programed instruction in unskilled hands and hug it to death."[26]

Programing in its present form is a newcomer in the field of education. If it more nearly realizes behavioral objectives than the conventional method of teaching, it can and will replace the older form. If the claims of programers are valid, "corroborating evidence ought to emerge from research into classroom use of programed material."[27]

In this chapter the background material in the history and problems of programed instruction has been considered under the following headings: 1) Introduction; 2) Justification for the study; 3) A brief history of programed instruction; 4) Rationale of programed learning; 5) Criteria for programed instruction; 6) The advantages of programed learning; 7) Disadvantages of programed learning; and 8) The role of the teacher in programed instruction.

Many individual research projects must be made and studied before corroborating evidence as to the superior merits of either the conventional or the programed form of teaching is established. Here follows a report of one such research project conducted in the Spring semester, 1971, concerning the relative superiority of conventional and programed teaching in twelve classes in remedial English, Tarrant County Junior College, South Campus, in Fort Worth, Texas.

Notes

[1]Allen D. Calvin, Programmed Instruction (London, 1969), p. viii.

[2]W. K. C. Guthrie, Plato, Protagoras and Meno (Baltimore, Maryland, 1956), p. 104.

[3]René Descartes, Discourse on the Method of Rightly Conducting the Reason and Seeking Truth in the Sciences. Trans. D. Sutherland and L. Knox (Edinburgh, 1850), p. 61.

[4]S. L. Pressey, "A Simple Apparatus Which Gives Tests and Scores--and Teaches," School and Society, XXIII, No. 586 (March 20, 1926).

[5]S. L. Pressey, "A Third and Fourth Contribution Toward the Coming 'Industrial Revolution' in Education," School and Society, XXXVI, No. 934 (November 19, 1932).

[6]B. F. Skinner, "The Science of Learning and the Art of Teaching," Harvard Educational Review, XXIV, No. 2 (1954).

[7]Julian I. Taber, Robert Glaser and Halmuth H. Schaefer, Learning and Programmed Instruction (Reading, Massachusetts, 1965), p. 1.

[8]Jerome P. Lysaught and Clarence M. Williams, A Guide to Programmed Instruction (New York, 1963), p. 1.

[9]Robert L. Thompson, "Programed Instruction and Reinforcement Theory: A View from the Laboratory," in Robert T. Filep, ed., Prospectives in Programing (New York, 1963), pp. 32-33.

[10]Lysaught and Williams, p. 7.

[11]Ibid.

[12]Thompson, p. 33.

[13]Lysaught and Williams, pp. 70-91.

[14]Ibid., p. 81.

[15]Thompson, p. 27.

[16]Edward L. Green, "Reinforcement, Programing, and the Human Organism," in Robert T. Filep, ed., Prospectives in Programing (New York, 1963), p. 38.

[17]Ibid., p. 39.

[18]Lysaught and Williams, p. 71.

[19]Ibid., p. ix.

[20]Shana Alexander, "The Gabbernot Has Got Me," Life, LXI (September 16, 1966), 38.

[21]Personal conversation with the late Walter Prescott Webb (circa June, 1962).

[22]New York Times, Section A (July 21, 1963), 5.

[23]Paul Saettler, "The Rise of Programed Instruction," School and Society, XCV (December 23, 1967), 536-37. Also see Calvin, p. 5.

[24]Calvin, p. 33.

[25]David Cram, Explaining Teaching Machines and Programming (San Francisco, 1961), p. 80.

[26]Thompson, p. 31.

[27]Lysaught and Williams, p. 11.

CHAPTER II

METHODS

The increasing multiplication throughout the country of community two-year colleges with open door policies and low tuition has placed college attendance within the reach of almost any young person who can present a high school diploma or any adult who can pass a high school equivalency test. Part of these students go from the community two-year college to a senior college or university. Some go to graduate school. They need a university parallel freshman English course. Others enter a two-year or a vocational program. They too need a mastery of certain communication skills so that they can write business letters, memoranda, technical reports, and use other written media to communicate the problems and solutions they encounter. In spite of the fact that these students are expected to leave the required freshman English courses with a similar standard of achievement, they enroll in such a course with a wide variation of levels in writing skills and techniques. Many come from an educational and environmental background that makes their ability to handle the English language far lower than that of the usual college entrant. These students may be deficient in one area or in several. Certainly the communication backgrounds and abilities of the students who enter the average community college are the most heterogenous ever represented at college registration.

Some students with one or more deficiencies in the ability to communicate in writing have spent their lives hearing and speaking a language filled with errors readily recognized by a grade school student who has enjoyed a different environment. Basically the student at this low level is relatively indifferent to the way he talks. Words are little more than sounds to him, vague symbols of things. Abstractions which conceptualize have no meaning for him. Sentences are only groups of sounds, not expressions of complete thought. If this student notices language at all, the incorrect word or phrase sounds correct to him, and the correct word or phrase seems incorrect. He may even attach a certain stigma to talking differently from the way he talks and hears his companions talk. Moreover, he will probably remain in the same physical-socio-economic environment while he receives his education.

At a higher level stands the student who can recognize and use fairly simple sentences and avoid the most obvious

errors of word usage. He still makes many errors with words, mistakes which lead to misunderstanding or to a breakdown in communication. Punctuation, capitalization, and the other mechanical symbols are a matter of emotion, irrational habit, or haste. He has no idea that sentence construction and sentence meaning bear valid relationship to reaching more adequate levels of communication.

Another group of students has extreme difficulty with correct spelling. This group may contain students who function adequately in other areas of communication and in other subjects and disciplines. Most teachers of this group however, complain that these writers make from two to ten spelling errors per page. Such pupils seem to accept this lack of ability as part of their personalities or fate and make no sustained effort to improve unless they are forced to concentrate on and work to remedy the inadequacy. Others have no idea how to improve ability to spell.

The largest group of those who lack communication skills commensurate with the level of the beginning competency of the average college freshman is made up of people with no idea how to build a complete, unified, orderly, coherent paragraph. Yet the paragraph is the basic unit of thought by which the student will express himself in college and in his later written communication. This student usually attempts to divide his writing mechanically to conform to his idea of the appropriate appearance of a paragraph. He has no conception of nor skill in this most fundamental unit of expression.

From this cursory description of a large number of entering college students, one fact is apparent: some will fail English immediately. Some will experience difficulty with English and with any other course that requires written communication. These students will remain in the class for a few weeks or months and then either drop the course or conclude it with a failure. Still others will pick up enough skills during the semester in class to pass but will never reach full potential. Obviously some intermediate language instruction should be required to fill in deficiencies of these people before they are allowed to attempt the regular freshman English course. Many colleges offer and require such courses.

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Examination of available course offerings for students who have one or more deficiencies in the ability to communicate in writing reveals two weaknesses. First, the approach to these courses is the same introduction and technical presentation which the student has met and found meaningless because the course is oriented to the way English teachers think. The student who needs remedial instruction in English in no way thinks in the structural forms and sequences of the professional English teacher. Furthermore, the student has failed to master the material presented in the usual way, and he expects to continue to fail. He is not motivated to do otherwise, and the repetition of the same material bores him. Second, the average course is set together like all traditional courses, with students beginning at the same level and moving at the same general rate. For instance, if a pupil masters spelling, basic word usage, effective sentence construction and adequate paragraph development, he will pass the course and will be prepared to begin his mastery of freshman composition. But if he is proficient in only three of the four areas, he will have accumulated enough passing grades to receive a passing mark, but he will not be able to handle material to which he was exposed and that he did not understand. On the other hand, if the student fails a larger portion of the material than he passes, he must repeat the entire course. He will be resigned and hopeless while he repeats and passes the material which he learned during his first exposure to the material, but he will have no additional time to study material which he had earlier found difficult because he is being forced to perform once again certain skills in which he has already shown competency. Consequently, sections of the course he first found difficult he will probably learn only slightly better at the second try. This time perhaps he will pass, but he will not be ready to perform competently in freshman English.

In an attempt to remedy such weaknesses in the remedial program, material in a programed course was divided into the following five areas: Correct Spelling through Sound-Symbol Correlation; Basic Word Usage; Effective Sentence Construction; Basic Paragraph Construction; and Advanced Paragraph Construction. For each area a package of self-teaching material was prepared. A determination of package requirements for each student was obtained through pretesting. If the student failed any section of any package, he restudied it, marked errors, determined difficulties, went over those areas with the help of the instructor who was present for tutorial service, and took an alternate test. No student was permitted to

leave one package and advance to another until he had mastered the contents of the first package.

Thus each student advanced at his own rate. No individual was allowed to try to build on incomplete and inadequate knowledge. He received no credit for the remedial course so far as graduation was concerned but the male student satisfied draft and veteran requirements in that he was allowed to count the remedial course as having a three-semester-hour value.

When two of the five packages had been devised, taught and tested to the satisfaction of the investigator, the program was tested for a semester, with two teachers presenting two sections each of the programed course.[1]

After a semester of trial presentation of the program, the experiment described herein was initiated and carried out. Six instructors taught one section each of the programed course which was called the Experimental approach. The same six instructors taught one section each of the traditional presentation of the course which was called the Control approach. Although the same material in general was presented to all classes, every effort was made to keep course presentations entirely separate as far as the administration of the course was concerned.

Both the Control and the Experimental groups were given the same pretests and posttests. Data on both groups were analyzed according to the following behavioral objectives:

Unit I. Correct Spelling through Sound-Symbol Correlation.

When the student had mastered the contents of the package for Correct Spelling, he should have been able to achieve the following behavioral objectives:

[1] Dr. Coramae Thomas, project director, had planned to devise all five packages of the programed material during the summer of 1970 so that the entire course would be ready for trial teaching in the fall of 1970. Because of an automobile wreck, Dr. Thomas remained in the hospital a large part of the summer. Therefore only the first two packages of the program were administered by Dr. Thomas and Mrs. Marjorie Barksdale who became program director when Dr. Thomas was killed in a second automobile accident on March 3, 1971. Hence the first two units of the program were prepared by Dr. Thomas. The last three units and the final report were written by Mrs. Marjorie Barksdale. Only the first package and approximately two-thirds of the second package had been taught at Dr. Thomas's death.

1. Hear the various vowel sounds represented by each vowel as it is pronounced, imitate the sound, and record the proper symbol for the sound.

2. Hear all the consonants and syllables in a correctly pronounced word, imitate the correct pronunciation, and record what he has said and heard.

3. Apply this correlation of symbol and sound by analogy and induction to basic spelling rules with some degree of ease and confidence.

4. Avoid the use of one correctly spelled word in the place of another correctly spelled word which has a different meaning.

5. Apply a few simple but varied spelling rules.

6. Apply knowledge of a few Latin and Greek prefixes and suffixes.

7. Keep a list of misspelled words and master these words.

The package was placed first in the course sequence on the basis of need for spelling indicated by pretesting. Because the principal basis for the spelling package was the establishment of correlation between sound and symbol, cassette tapes were used and were played over earphones in individual booths in the learning resource center. The student saw the printed word and heard it pronounced correctly over the tape. He repeated the sound exactly as he had heard it. He wrote what he had said. Thus his ear was trained to hear the correct sound spoken first by the voice over the tape and then by himself. He wrote the word so that his muscles were trained to write as his eye was trained to recognize the correct spelling both in print and in his own handwriting.

Unit II. Basic Word Usage.

When the student had mastered the contents of the package for Basic Word Usage, he should have been able to do the following:

1. Recognize the basic parts of speech--nouns, verbs, adjectives, adverbs, prepositions, and sentence connectives.

2. Realize that the essential core of each sentence is the subject-verb relationship or the subject-verb-complement relationship and that adjectives and adverbs add supplementary information.

3. Be able to avoid in writing and speech the errors of word usage considered sub-standard, such as incorrect pronoun case, lack of subject-verb agreement, and confusion of adjective and adverb.

4. Have sentence sense which enables him to write and to speak in complete sentences.

5. Avoid combining several sentences without separating them with proper punctuation.

In the presentation of the package for basic word usage, motivation to change speech and writing habit patterns was stressed throughout each section. Because students in this group learn more readily through what they hear and do than through what they read, correct usage was taught through three senses: hearing, seeing, and the physical feeling of saying and writing the word or the expression correctly. Only the most basic errors were attacked per se. Explanations and exercises were kept at an eighth grade level in vocabulary, sentence length, and construction.

Written work of students who rated below the twenty-fifth percentile on the entrance test at the school at which the experiment was conducted had been preserved over the last two semesters and tabulated by computer to locate the most frequent basic errors. Although a few mistakes in speaking and in writing were regional, few major differences were indicated.

Unit III. Effective Sentence Construction.

When the student had mastered the contents of the package for Effective Sentence Construction, he should have been able to do the following:

1. Recognize the basic sentence patterns and their subdivisions as components indicating core thought and elements of additional information.

2. Understand that groups of words such as phrases and clauses can function as individual parts of speech as part of the basic sentence pattern or as adjuncts to the primary subject-verb sequence.

3. Use subordination and coordination to show the relationship of ideas within a sentence.

4. Avoid word usage errors not immediately obvious which cause unclear or inaccurate writing.

5. Use punctuation marks, capital letters and other mechanical aids in writing.

Because the above listed objectives sound familiar to one who has taught the conventional English class, it may appear that the material outlined here is that which may be found in any handbook of grammar. The material is of course the same but the traditional handbook approach was not used in this package of the program. Grammatical terms were utilized only when they served as convenient label tools. The student was guided to strive for word usage and sentence construction which would make his communication more accurate, exact, and effective. He studied sentence structure as a means of making the relationship of his facts and ideas clear, impressive and emphatic.

Unit IV. Basic Paragraph Construction.

When the student had finished the package for Basic Paragraph Construction, he should have been able to do the following:

1. Distinguish between general statements and statements containing supporting details.

2. Recognize the basic thought governing a paragraph and phrase that idea concisely in a topic sentence.

3. Recognize and choose a purpose for writing a paragraph.

4. Select enough supporting details to support the topic sentence.

5. Omit details not relevant to the topic sentence and to the writer's purpose.

6. Write a simple paragraph according to the patterns of process analysis, sequence of details, and classification.

Paragraph unity and completeness are relatively easy to teach a student once he knows that the paragraph is a whole, a complete structure, and that the identification of the structure is made in the topic sentence, whereas the remainder of the paragraph is made up of sentences containing details necessary to establish, to clarify, or to emphasize the essential thought expressed in the topic sentence. The student was shown the difference between sentences containing ideas or generalizations and those containing details or particulars. He was aided in the choice of a central idea and of a purpose around which his ideas would center.

Beginning paragraphs were based upon simple writing patterns which the pupil customarily used in spoken and later in written communication. The paragraph of process analysis, for instance, was an answer to the pupil's earliest and most simple questions concerning what, how and why. The paragraph developed through specific examples reflected the writer's most obvious thought processes and experiences. The paragraph of classification, the most difficult paragraph in the unit, provided a transition to the more advanced patterns in Unit V, Advanced Paragraph Construction.

Unit V. Advanced Paragraph Construction.

When the student had finished the package for Advanced Paragraph Construction, he should have been able to do the following:

1. Plan, organize and write a paragraph based on the pattern of definition.

2. Compose a paragraph of classification around the central idea of an objection to a generally accepted idea or concept.

3. Write a paragraph of comparison.

4. Write a paragraph of contrast.

5. Combine comparison and contrast into one paragraph.

6. Write a paragraph of causal analysis.

The materials described above were presented to the Control group through the procedures and techniques of the

traditional classroom approach to learning. The basic text was supplemented by student practice in the writing of paragraphs and by reading and discussion of essays. Spelling was taught by analysis and memorization. Although each instructor in the experiment taught one Experimental group and one Control group, each teacher maintained, insofar as possible, a completely different procedural and instructional approach while presenting the same materials to the two groups of the experiment.

Since the programed course was designed to be administered in an open-end semester, the possibility of failure did not exist so long as the student continued to enroll for the course. Theoretically the grade at the end of the semester was designed to be either P (Pass) or P-C (Pass-Continue) if the student had not completed the entire five packages. The course was not so structured during the semester of experimentation upon which the research described herein was based. Another recommendation for projected administration of the course was that the student should be required to study only those packages in which he possessed deficiencies. Again this feature was not included in the semester of experimentation.

Because the student would never fail the programed course, he was required to continue to take tests on a lesson of a package on which he had made a posttest score of less than 85. The second test was called the Alternate Posttest. The student frequently had to take one or more Alternate posttests.

Testing for the Control group was administered according to the decision of each individual instructor concerning the appropriate time to take the posttest. Spelling, for example, was taught concurrently with the other materials in the Control groups. Hence the final test in Spelling did not occur until near the end of the semester, whereas the Experimental group studied an entire package of Spelling and took the test immediately after the conclusion of the unit. Both the Experimental and the Control groups took the same tests. Because the tests were structured accord- to the tests of the program, it cannot be established that the tests were not weighed somewhat in favor of the Experimental group. Since both groups were exposed to the same content material, it cannot be established that the tests were more favorable to the Experimental group.

Material in Chapter II included a general introduction; objectives and methodology in the units; a description of grade standards; and a discussion of testing.

CHAPTER III

FINDINGS AND ANALYSES

Estimates of the reliability of the test instruments administered were made on selected tests: the pretest and posttest on lesson 1, Unit I, Spelling through Sound-Symbol Correlation, and on the general comprehensive final for the five units. Using the Spearman Brown statistic (Nunnally, 1967), the reliability of the spelling pretest was 0.85, the spelling posttest 0.65, and the comprehensive final examination 0.88.

The primary interest in the research was to discover whether there were significant differences in the performance of the Experimental and Control groups on all of the pretests and the posttests of the remedial course. Differences in performance attributable to different teachers; number of years since the student had attended school; method of entrance into the course; possible significance of age on performance; and possible significance of sex on performance were analyzed. To accomplish these objectives, separate one factor multivariate analyses of variance were run of the data for each of the variables listed above. Multivariate analysis of variance (MANOVA) is similar to the well known univariate analysis of variance (ANOVA) in its attempt to establish the existence and significance of differences between groups with regard to their scores on variables of interest. In an ANOVA only one dependent variable at a time can be taken into account, while in a MANOVA a set of variables can be considered simultaneously. If a MANOVA does establish the significance of a difference between two or more groups with respect to a set of dependent variables, examination of the group means can be made to determine the source of the difference. For a more detailed discussion of MANOVA see Nunnally (1967) or Morrison (1967).

Multivariate analyses of variance were carried out for pretest scores, posttest scores, and improvement scores of both the Experimental and the Control groups. The improvement scores were formed by subtracting prescores from postscores for each individual. Knowledge of significant pre-instructional differences were considered important in interpreting differences in the postscores and improvement scores. The most important portions of the analyses with regard to the evaluation of the success of the program were the multivariate analyses of variance on the scores of the Experimental and Control groups. The first of these analyses was done on the prescores to determine if a priori

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differences between the two groups existed. Fortunately for the sake of interpretation, no significant difference was found. The MANOVA on the posttest scores resulted in a significant chi-square (X^2) of 284.67 which with 30 degrees of freedom (df) is significant at the 0.001 level. As one can see by examining the means in Table 1, the Experimental group scored uniformly better on the posttests except for the unit on Basic Paragraph Construction. The failure of the Experimental group to score as well or better than the Control group on Basic Paragraph Construction is at least partly explainable by the fact that the Control group scored better on that unit on the pretests. The improvement score MANOVA produced an X^2 of 26.73 with 5 df which is significant at the 0.001 level. As Table 2 reveals, the improvement for the Experimental group was greater than that for the Control group on each of the five units. This superiority is interpreted as evidence that the Experimental program was superior to the previously employed program of traditional classroom procedures with respect to overall improvement on the five areas measured by the tests.

Of incidental interest is the fact that the means for the unit on Basic Word Usage on the improvement scores were conspicuously low for both the Experimental and the Control groups. This imbalance suggests that the unit on Basic Word Usage is relatively weak and could benefit from reexamination.

The set of multivariate analyses of variance was done to determine if significant differences exist in the effectiveness of the several teachers involved in the program. The multivariate analyses of variance for the pretest scores, posttest scores, and improvement scores were all highly significant. The large differences in the improvement scores in means for students grouped by teachers indicate in Table 3 that the teacher is an extremely important variable in both the Experimental and the Control groups.

The next phase of the analysis was a comparison of performance of students admitted to the remedial course with a high school diploma and students admitted with some other form of qualification, for example, a certain level of achievement on the General Educational Development test. The pre-score MANOVA for these two groups resulted in a significant X^2 of 14.85 with 5 df and $p \leq 0.025$. As Table 4 indicates, high school students produced a higher score on each of the pretests except Basic Word Usage. The MANOVA on postscores yielded an X^2 of 19.05 which with 5 df is significant at the 0.005 level.

TABLE 1

MEANS FOR EXPERIMENTAL AND CONTROL GROUPS*

	Unit I	Unit II	Unit III	Unit IV	Unit V	Final
			Pretests			
Experimental N=74	109.84	81.42	11.60	2.36	1.10	-
Control N=74	112.07	77.77	11.64	2.59	2.12	-
			Posttests			
Experimental N=74	126.61	82.03	18.45	3.66	4.05	78.23
Control N=74	120.24	71.55	17.37	3.78	3.46	76.42

TABLE 2

IMPROVEMENT SCORES FOR EXPERIMENTAL AND CONTROL GROUPS

	Unit I	Unit II	Unit III	Unit IV	Unit V
Experimental N=74	16.76	0.74	6.85	1.30	2.15
Control N=74	8.18	-6.11	5.71	1.19	1.29

*Unit I - Spelling through Sound-Symbol Correlation
Unit II - Basic Word Usage
Unit III - Effective Sentence Construction
Unit IV - Basic Paragraph Construction
Unit V - Advanced Paragraph Construction

TABLE 3

MEANS FOR STUDENTS GROUPED BY TEACHERS

	Unit I	Unit II	Unit III	Unit IV	Unit V	Final
			Pretests			
Group 1 N=27	76.15	82.78	13.78	1.85	0.67	-
Group 2 N=29	116.48	90.07	10.59	2.07	2.00	-
Group 3 N=22	121.77	95.36	14.36	3.86	3.23	-
Group 4 N=18	118.44	89.72	9.72	2.61	2.83	-
Group 5 N=27	121.26	39.04	11.78	2.18	2.00	-
Group 6 N=25	116.08	86.64	9.26	2.64	1.84	-
			Posttests			
Group 1 N=27	116.70	89.26	20.22	4.07	3.56	87.04
Group 2 N=29	122.31	69.83	17.16	3.24	3.62	68.34
Group 3 N=22	130.00	69.68	18.77	4.27	4.32	68.91
Group 4 N=18	121.83	79.17	17.06	3.78	3.72	73.56
Group 5 N=27	124.74	75.67	18.63	3.63	3.48	89.44
Group 6 N=25	125.92	77.16	15.38	3.48	3.96	74.28
			Improvement Scores			
Group 1 N=27	40.52	6.85	6.44	2.22	2.89	-
Group 2 N=29	5.83	-20.31	6.56	1.17	1.62	-
Group 3 N=22	8.23	-25.68	4.41	0.41	0.91	-
Group 4 N=18	3.39	-10.56	7.33	1.17	0.89	-
Group 5 N=27	3.48	36.63	6.85	1.44	1.48	-
Group 6 N=25	9.84	-9.08	6.04	0.84	2.12	-

TABLE 4

MEANS FOR HIGH SCHOOL GRADUATES AND GENERAL EDUCATIONAL DEVELOPMENT ADMISSIONS

	Unit I	Unit II	Unit III	Unit IV	Unit V	Final
Pretests						
High School Graduates N=110	114.51	79.44	11.72	2.63	2.24	-
GED Admissions N=32	102.53	80.72	11.42	2.16	1.38	-
Posttests						
High School Graduates N=110	124.97	75.28	17.70	3.73	3.87	75.99
GED Admissions N=32	120.88	81.06	18.79	3.72	3.47	81.44
Improvement Scores						
High School Graduates N=110	10.45	-4.07	5.96	1.10	1.59	-
GED Admissions N=32	18.34	0.59	7.37	1.56	2.09	-

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It should be noted that students admitted to the remedial course through the passing of the General Educational Development test scored higher on Basic Word Usage, Effective Sentence Construction, and the comprehensive final examination. High school students scored higher on Spelling through Sound-Symbol Correlation, Basic Paragraph Construction and Advanced Paragraph Construction. The MANOVA on the improvement scores was not significant at even the 0.05 level. These results can be interpreted to indicate that while students admitted to the course with a high school diploma and students admitted through the General Educational Development test have different areas of strength and weakness as the various test means indicate, no major overall differences between the two groups in terms of posttest scores were found. Further, no evidence was found to suggest that there are differences in the abilities of the two groups to learn programed material or remedial material presented through conventional classroom procedures.

The performance of students who had been out of school 0 to 2 years, 3 to 6 years, and more than 6 years before beginning the remedial course was compared. As Table 5 reveals, the only significant difference was in the post-test score analysis which resulted in a X^2 of 25.00 which with 12 df is significant at the 0.025 level. Examination of Table 5 shows that the group away from school for more than six years made higher scores on each of the tests except the one on Basic Word Usage which, as has been indicated, could benefit from re-examination.

The means on the various tests broken down by age are indicated in Table 6 and the means on the various tests broken down by sex are indicated in Table 7. No important differences were found between groups differing on these variables.

Because a comparison of the Experimental and Control groups constituted the heart of the research, only scores of the 148 students who completed the entire battery of tests, Units I - V, were used for analysis. The factor of student drop-out, always high in a remedial course in a junior college with an open-door policy, was not considered. When data on minor variables were not available, these students were not considered in subsidiary analyses.

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TABLE 5

MEANS FOR STUDENTS GROUPED BY YEARS OUT OF SCHOOL

	Unit I	Unit II	Unit III	Unit IV	Unit V	Final
			Pretests			
0-2 years N=58	109.72	84.50	11.24	2.45	1.81	-
3-6 years N=37	112.49	76.16	11.30	2.30	2.14	-
7 or more years N=36	116.67	73.47	12.24	2.86	2.36	-
			Posttests			
0-2 years N=58	122.98	78.26	17.23	3.55	3.71	74.48
3-6 years N=37	120.32	73.51	17.46	3.59	3.59	77.14
7 or more years N=36	128.69	75.47	18.83	4.00	4.03	79.17
			Improvement Scores			
0-2 years N=58	13.24	-5.90	5.95	1.10	1.83	-
3-6 years N=37	7.84	-2.65	6.16	1.30	1.46	-
7 or more years N=36	12.03	2.00	6.60	1.14	1.67	-

TABLE 6

MEANS FOR STUDENTS GROUPED BY AGE

	Unit I	Unit II	Unit III	Unit IV	Unit V	Final
Pretests						
18-25 years N=92	109.51	82.43	11.39	2.37	1.83	-
16-35 years N=37	113.22	78.08	11.89	2.81	2.32	-
36 or more years N=14	118.93	65.21	12.64	2.57	2.78	-
Posttests						
18-25 years N=92	121.77	77.33	17.65	3.62	3.70	75.84
16-35 years N=37	125.59	75.46	18.53	3.89	3.76	78.76
36 or more years N=14	130.50	74.28	18.46	3.93	4.36	81.71
Improvement Scores						
18-25 years N=92	12.25	-4.91	6.24	1.25	1.83	-
16-35 years N=37	12.38	-2.62	6.64	1.08	1.43	-
36 or more years N=14	11.57	9.07	5.82	1.36	1.57	-

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TABLE 7

MEANS FOR STUDENTS GROUPED BY SEX

	UNIT I	UNIT II	UNIT III	UNIT IV	UNIT V	Final
			Pretests			
Male N=107	109.91	80.30	11.46	2.40	2.01	-
Female N=34	114.85	77.56	12.10	2.91	2.24	-
			Posttests			
Male N=107	122.77	76.13	17.78	3.70	3.71	76.34
Female N=34	126.06	77.82	18.50	3.79	4.00	79.47
			Improvement Scores			
Male N=107	12.85	-4.19	6.31	1.30	1.70	-
Female N=34	11.20	0.85	6.34	0.88	1.65	-

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Conclusions based on the research to discover an effective method of teaching communication skills to college freshmen with one or more deficiencies in the ability to communicate in writing have been divided into the following categories: 1) specific conclusions based on the program written, rewritten, and taught at Tarrant County Junior College, Fort Worth, Texas, from the period June 1, 1970, to June 1, 1971; 2) general conclusions involving programed learning in the field of remedial English.

Conclusions concerning the program at Tarrant County Junior College.

A. Unit I. Spelling through Sound-Symbol Correlation.

Unit I replaced the traditional approach of learning to spell through memorization with a logical analysis of the word to be spelled through a correlation of the sound and the symbol. Possible attestation to the popularity of Unit I was seen in the excellent attendance of both the Experimental and the Control groups although this fact is not necessarily indicative of merit of the unit because the remedial course is always well attended during the first weeks with subsequent high attrition of students. Improvement in the Experimental group was sizable. Pupils stated that they regarded Unit I as "a challenge to do something about enduring spelling difficulties."

The unit containing ten lessons was disproportionately long in comparison with the number of lessons in the other units. If the course had been structured to be administered during two semesters, the time spent on spelling could have been justified. Merit of all the lessons is indicated by the difficulty of an editor in deciding which units to eliminate. All of the lessons in Unit I were useful. In a one-semester course, however, the number of lessons should be shortened.

B. Unit II. Basic Word Usage.

Unit II, as has been indicated above, could benefit from re-examination. Students had difficulty in understanding terms and directions. Deficiencies in reading slowed progress. Unit II proved the exception to the otherwise uniformly high scores on pretests made by those entering the course with a high school diploma and on pretests made by the group who had been away from school more than six years. In spite of the fact that pre-established behavior

objectives were not achieved as satisfactorily as those of the other four units, the material is valuable in that it contains the seasoned teaching techniques of an experienced and able classroom performer and writer.

C. Unit III. Effective Sentence Construction.

Difficulties initially encountered in Unit II in reading and in understanding directions and materials continued to plague Unit III. Students were required to learn certain "rules of grammar" involving functions of phrases and clauses. Because the sentence is the indispensable vehicle for conveying thought, the importance of Unit III cannot be overemphasized. Clarity, accuracy, coherence, and emphasis, to say nothing of the finer shadings of style, depend upon knowledge in and application of functions of the components of the sentence. That many people refuse to avail themselves of the multiplicity of effective combinations of words is responsible in part for the aridity of much prose writing. Difficult though it is to create out of the raw materials of the human spirit that which has never been before, it is perhaps even more agonizing to give voice to the thought. Young and old "know what it is but just can't say it." Many stop trying to reveal themselves in words.

The lack of satisfactory performance in the area of Basic Sentence Construction was not restricted to the specific program here under consideration. The poor performance seen in the Experimental group was also found in the Control group.

Unit III suffered further from lack of reinforcement exercise material. Because too much time and material allotment had been reserved for the first two units, an inevitable acceleration of the last three more difficult units was necessary.

The formal division of material in Unit III constituted a teaching technique which went out of fashion in the 1930's. The trend in the 1970's in remedial and indeed in more sophisticated composition is the following of the encouraging suggestion: "Just sit down and write." The approach of Unit III was "Write according to pattern." Such an approach is confessedly old-fashioned teaching. Admittedly the approach did not work very well. Neither did the free writing approach. Perhaps part of the difficulty encountered in Unit III was caused by a lack of invention--a subject without the province of this study.

D. Unit IV. Basic Paragraph Construction.

Dealing with the simplest and most obvious strategies for writing an expository paragraph, Unit IV was concerned primarily with the achievement of unity in writing. The unit included work with the topic sentence, supporting details, the paragraph of example, together with paragraph patterns for process analysis and classification. Noteworthy is the relative performance of the Control group which in Unit IV was able to approximate the performance of the Experimental group. Here the Control group scored higher on pretests of the unit than did the other group. Although higher pretest scores of the Control group may be one reason for their excellence in performance, other reasons without the scope of this research exist.

With the introduction of techniques of writing paragraphs, the programed course ran parallel to the course in freshman composition. It should be noted that the approach in Units IV and V, Basic and Advanced Paragraph Construction, was not Skinnerian but rather was a reversal to the theory of "learning by doing." Perhaps the higher scores of the Control group in this particular unit indicate that the material of the unit can be handled and learned more effectively in the conventional classroom. Perhaps it leans heavily on the Gestalt rather than the Skinnerian techniques of learning.

E. Unit V. Advanced Paragraph Construction.

It should be noted that advanced paragraph construction is usually reserved for freshman composition. If it is well learned in the remedial course, the freshman course will not prove the arduous experience in writing that sometimes characterizes it. Lack of class hours was responsible for lack of supplementary reinforcement material. It should be noted that the first two units of the program were entirely objective. The student was given an either/or choice on a linear paradigm. In the last three units, the pupil wrote. Thus the scoring of tests in these units demanded a more complicated grading pattern. Every effort was made, however, to follow objective standards and to maintain rigorous conformity in evaluation.

General Conclusions

Based on an examination of programed learning in general, the following conclusions are offered:

1. A programed approach to learning must have a valid, precise, and complete enunciation of objectives.
2. Content and methodology must be shaped to achieve predetermined goals.
3. Content which possesses areas of weakness must be revised or completely rewritten.
4. If the pupil fails, the program fails.
5. In order to justify change to programed learning, the program must be proved better than the traditional classroom approach.
6. A strong asset of programed learning is individual race of pupil progress.
7. The programed approach to learning possesses rich adaptability to meet democratic and economic demands for universal education.

RECOMMENDATIONS

Specific Recommendations

The following revisions of the program described herein are recommended:

1. A reduction in lessons in Unit I from 10 to 8 lessons.
2. A reexamination of Unit II which should include 8 lessons.
3. An extension of Unit III from 5 lessons to 10 lessons.
4. An extension of Unit IV from 3 lessons to 10 lessons.
5. An extension of Unit V from 3 lessons to 5 lessons.
6. An open-end semester to allow for individual pacing.
7. An independent final examination.
8. A follow-up examination for recall.

Additional material in Units III, IV, and V should consist largely of reinforcement materials.

Other specific recommendations are that the teacher should do no grading(A student grader should be in attendance) and that a comparison of scores made by Experimental and Control groups on standardized tests should be made.

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Further subjects for investigation of certain factors important in the evaluation of the program include:

1. Follow-up of student success in freshman composition including drop-outs in freshman composition; rank of students of the Experimental and Control groups in freshman composition; and types of errors made by these students in freshman composition.

2. A consideration of drop-outs including the relative number of drop-outs in Experimental and Control groups; reasons for student drop-outs: difficulty of course, structure of course, dullness of course, irrelevance of course from student standpoint, or other reasons.

3. Relation of size of class to pupil performance and of size of class to teacher success with program.

4. Teacher evaluation of programed course from the teachers who participated in the experiment.

5. Student evaluation of programed course.

6. Time required for student to finish one package, the entire course, and time extension from one semester for the finishing of the course.

7. Special problems of special groups.

8. Rate of improvement on posttest scores as compared with alternate posttest scores.

9. Research in the area of teacher variable.

General Recommendations

1. Further research on the efficacy of a course in remedial English which combines the programed and the conventional classroom approaches.

2. Further education of teachers in the writing and teaching of the programed course.

3. The use of the program in the conventional class for enrichment, review, or remedial supplement.

4. Research in the writing of a programed course for that most difficult English course: freshman composition.

5. Research in a programed course in English literature, American literature, and even literature of the East.

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The role of education today is demanding, the tasks rigorous, the need imperative because education for survival is neither a slogan nor a shibboleth but a fact. Without doubt the one-to-one relationship between teacher and pupil is the desideratum, but there are not enough logs in the world for Mark Hopkins and his one student. Programing may be the answer to the necessity for total education, a goal new under the sun, a dream not even beginning to be realized. Programing may not be the answer. It is too soon to tell.

Whether the educational theorist views the educative process as a great commercial activity: "Let no one think that education is less a commercial endeavor than the competitive manufacture of soap; it is just not so well organized, financed, or staffed"[1]; or as the key to the salvation of the planet, the task is with us and continues to proliferate as population continues to explode. The principle of psychological reinforcement of acceptable behavior and the conditioning out of unacceptable behavior, already demonstrated to be effective in programed learning, is so persuasive to author B. F. Skinner that he would apply it to the whole of human society in the development of a "technology of behavior which leaves no room for individual freedom or dignity."[2] To the British critic C. S. Lewis who wrote that man is being abolished through Skinnerian psychology, Skinner answers that if Lewis means today's over-autonomous man, then that man's abolition is long overdue for he is about to destroy us. Whether or not Skinnerian psychology is applicable to the improvement of the social order, it has in one small research experiment with remedial English at the college level proved itself effective. But the fields of experimentation are increasingly green and the laborers are few.

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[1]Robert L. Thompson, "Programed Instruction and Reinforcement Theory: A View from the Laboratory," in Robert T. Filep, ed. Prospectives in Programing (New York, 1963), p. 30.

[2]Victor Cohn, "Psychologist Says Free Man's Culture Can't Survive," Fort Worth Star Telegram (Thursday Evening, August 5, 1971), Section B-8, quoting B. F. Skinner, Beyond Freedom and Dignity to be published in 1972 and condensed in Psychology Today, August, 1971.

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